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Research Paper

Pre-natal Influences of Intellectual Disabilities

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ABSTRACT

Intellectual disability (ID) is permanent and highly disabling conditions that adversely affect the normal well-being and mental health of the parents. Intellectual Disability is a one of the major disabilities under the Rights of the Persons with Disability Act (RPWD Act) 2016. It is a condition of arrested or incomplete development of mind. RPWD Act, 2016 defined intellectual disability in the terms of significant limitations in intellectual functioning and adaptive behavior and manifested during the developmental age, i.e. before the age of 18 years of life. Intellectual functioning includes limitations in reasoning, learning, problem-solving skills, cognition, etc. Intellectual Disabilities can be caused by many genetic factors, environmental and psycho-social factors among them prenatal influences up on the development of the child occupied the most supreme position. Therefore, this study aims to identify the influences of prenatal factors on the birth of children with intellectual disabilities.

Keywords: *Prenatal Influences, Intellectual Disabilities, Genetic Factors, Environmental Factors*

Today, it is a fact that the prenatal environment when a child lives within the mother's womb is a very important in determining the course of development of the child. Deformity and malformation in the prenatal stage may lead to intellectual disability. The prenatal period is defined as a process of rapid change and growth that occurs during the 40 weeks prior to the birth of a child. Normally, the conditions of the prenatal environment are such that promote the normal development of the fetus as well as it has tremendous chances of great vulnerability to develop deformities. Any deviation from normalcy in the environment may produce developmental irregularities in the child, even to the extent of making them physically and intellectually disabled.

The developing fetus is passes through three stages:

1. Germinal stage
2. Embryonic stage and
3. Fetal stage.

Each and every stage has a significant effect on the development of the child prior to their birth that will be examine one by one below:

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(i) The Germinal stage:

The germinal stage begins when the sperm and egg cells unite in the fallopian tube. This stage generally lasts from conception to two weeks during which implantation took place. The fertilized egg is now called zygote. At this stage, cell division and growth took place at a rapid race.

(ii) The Embryonic Stage:

The duration of the embryonic stage is about two weeks to 8 weeks. Rapid changes will take place during this stage and internal organs start to develop. After the zygote divides into several segments, it travels in the fallopian tubes and implants itself in the lining of the uterus of the mother. After implantation, this multicellular organism is now called an embryo. Now blood vessels will grow and form the placenta. The placenta is a structure connected to the uterus that provides nourishment and oxygen from the women's body to the developing embryo through the umbilical cord.

This embryonic stage is further divided into three separate layers:

a) The Ectoderm: it is the layer that will become the nervous system and outer skin layers.
b) The mesoderm: It is the layer that will become the circulatory system, skeleton, muscles, reproductive system, and the inner layer of skin.
c) The Endoderm: It is the layer that will become the respiratory system and part of the digestive system and urinary tract.

(iii) The fetal stage:

From around nine weeks of pregnancy to thirty-eight to forty weeks, until the baby will get born, is usually considered as fetal stage. Throughout this stage, the brain continues to grow and develop rapidly. When the organism (embryo) is about nine weeks old, it is called a fetus. Following changes will take place during this stage:

Duration Development

9 weeks Fetal stage begins, reflexes begin to appear, and the arm and legs start to move.
12 weeks Sex organs differentiated.
16 weeks Fingers and toes develop, fingerprints are visible.
20 weeks Hearing begins.
24 weeks Lung begins to develop.
28 weeks Brain grows rapidly.
32 weeks Bones fully develop.
36 weeks Muscles fully develop.
40 weeks of Full-term development.

If birth will took place around 36 weeks of pregnancy, the baby is in the position to survive outside the womb of the mother. Such delivery is called premature delivery. At this period, the weight of the baby will be around 6 pounds and length about 18.5 inches long. If birth will took place by week 37, most of the fetus organs developed fully and the fetus can survive outside of the uterus without any risk if premature delivery. The fetus continues to grow and length and weight increase till 40 weeks. At that time the mother's womb is very little room to move the child and birth becomes imminent. The average baby who will born in full term maturity are having weight of 6 pounds 2 ounces to 9 pounds 2 ounces and average length will be 19 to 21 inches (Barker, 2007).

Prenatal development is also divided into three trimesters. These three trimesters do not necessarily correspond with the previously described three stages. The first trimester lasts up to 8 weeks, i.e. up to the end of the embryonic stage. The second trimester goes up to week 20 and the third trimester ends at birth.

Challenges and issues

Prenatal care is crucial in making sure that the mother will have the healthiest and safest pregnancy possible. Regular doctors' visits are essential to track weight gain, general health, and to check on the status of the cervix and uterus. It is time when careful monitoring of pregnancy is essential, such as diabetics, and those with preeclampsia. Many women do not seek prenatal care due to lack of the cultural practice, illiteracy, lack of medical insurance, financial hardships, difficulty finding a doctor, and many other personal barriers.

However, there are many government-aided programs and services to provide pregnant women. Prenatal care, a healthy diet, a low-stress environment and avoiding teratogens are crucial to ensure a healthy prenatal environment for pregnant women and for growing babies.

Due to the malnutrition to pregnant women, maternal health hazards, maternal diseases, and several other teratogens, most frequently premature delivery may take place that is dangerous for both the mother and the child. Premature delivery is defined when the baby is born around 36 weeks of pregnancy. There are three types of premature delivery:

i. Early preterm delivery: If the child will be born before 28 weeks of pregnancy. Such children are having a very low probability to survive.
ii. Mid preterm delivery: If the child will be born between 28 and 32 weeks of pregnancy.
iii. Late preterm delivery: If the child will be borne between 32 to 37 weeks of pregnancy.

There are several factors responsible for premature delivery (Von Dommelen, et al. 2004). Some of these factors are:

- Abnormal size and shape of the uterus of pregnant women.
- The mouth of the uterus is opening quickly.
- Pregnant women are suffering from high blood pressure, having diabetes, or suffering from liver problems.
- If protein is passed through urine, and it is not treated at all.
- Elevated liver enzymes and low platelets level may often lead to premature delivery.
- Urinary tract infection or infection in the uterus.
- Previous history of premature delivery.
- Use of alcohol, tobacco, self- medication, carrying heavy load, accident, etc. during the pregnancy.
- Environmental teratogens – stress, anxiety, negative attitude towards the baby, negative emotions passed by the family members, etc.

1. **Multiple pregnancies:** If more than two fetuses are developing at a time in the mother's womb, then chances are increasing for premature delivery. It has happened in 60 % of cases of twins and 90 % of cases of triplets. If the two fetuses are developing at a time in the womb, then it may possible that they may take birth at 36 weeks if

three fetuses are developing – they may take birth by 32 weeks and if the four fetuses are developing – they may take birth at 30 weeks (Blickstein, 2004).

2. **Fewer gaps between the births of two babies:** If the minimum gap between the births of two babies is less than 18 months, then chances increase for premature delivery in the second-born baby.
3. **Age of pregnant women –** those women who conceive at a very low age (less than 18 years of age) and very high age (more than 35 years of age) are often susceptible to produce premature delivery.
4. **The emotional state of the mother:** If the pregnant women are often tensed, stressed, frustrated, and depressed they may produce premature delivery. In such an emotional state the body of pregnant women may secrete adrenaline and cortin hormones in high quantity which are responsible for premature delivery.
5. **Poor lifestyle:** Lack of nutritional supplements in the food of pregnant women, neglecting health hazards, lack of prenatal care, and the mother is alcoholic or frequently smoking may also leads to premature delivery.

(B) Environmental Impacts on Prenatal Development

A developing fetus is continuously affected by a number of environmental dangers throughout the prenatal stage. The growing fetus is totally dependent on the mother for their life. Prenatal care during pregnancy is essential to monitor the health of pregnant women, and the baby who is developing in the womb of the mother. Routine prenatal care may reduce the risk of complications, if any, during the pregnancy.

When the zygote attaches to the wall of the uterus, the placenta is formed. The placenta provides complete nourishment and oxygen to the growing fetus. Whatever the pregnant women ingest, whether it is solid food, liquid, or even medications will travel to the fetus through the placenta. Hence, it one of the well known says that pregnant mother will, "eats for two." If the mother expose with environmental hazards, it will affect the fetus. Harmful and serious environmental hazards will affect the growing fetus, and the child can show lifelong effects. Some environmental hazards are enumerated below:

Maternal Nutrition: The developing fetus gets its supply of food from the mother's blood through the placenta. Hence, mother's diet must contain all the essential nutrients in sufficient quality. The mother must not be hungry for a longer duration. There are two types of hunger:

Quantitative hunger: it is an insufficient supply of food.

Qualitative hunger: It is lack of enrichment of vitamins, minerals, and other nutritional supplements.

Mild hunger of any type is not serious, but severe and prolonged hunger of any type is injurious. Malnutrition (qualitative hunger) is more hazardous than insufficient food (quantitative hunger). It is because malnutrition results in vitamin deficiency whereas insufficient food may not produce vitamin deficiency. The unborn baby usually gets their diet due share from the mother, even at the cost of her malnutrition. (Hogberg, et al. 2012).
Serious malnutrition of the mother leads to mental deficiency or to some physical abnormalities in the child such as Rickets, nervous instability, general physical weakness, epilepsy, cerebral palsy and other neuropsychiatric disabilities. A deficiency of vitamin B in expectant pregnant mother's diets has been found to affect the intelligence of the children

during the early years of life. Poor school performance has also been found to be affected by malnutrition during pregnancy (Coad, 2002).

Prolonged malnutrition due to poverty, war, ignorance of proper food values, or the mother's desire to stay slim has been reported in several studies to be a serious hazard to the unborn child. Although malnutrition may occur in any mother, it is most likely to be presented in mothers of the lower socio-economic groups. In the upper socio-economic groups, pregnant women may also suffer from malnutrition, and it is due to their desire to stay slender. This fact is especially serious in early marriages because many young mothers are suffering from either malnutrition or their desire to stay slim and trim when their pregnancy begins (Wu. G. et al., 2004).

In our Indian context, the causes of malnutrition are many. Some of them are as follows:

1. Fashionable dieting by the pregnant women.
2. The double standard possesses by the parents during the upbringing of children of both sexes (male and female), which accounts for the general malnutrition in the pregnant women.
3. The women of the family are supposed to get satisfied with the food left after the males of the family has taken their meals. The leftover food may lack the most important nutrients and make the womenfolk malnourished.

Teratogens

A teratogen is defined as any environmental substances or agents that have a significant adverse effect on a developing fetus. These environmental substances or agents may be found in the form of biological, chemical, or physical molecules that produce some negative effects on the fetus. During the prenatal stage, exposure to these teratogens may raise the risk of birth defects (Gluckman, 2008).

It is always advised to avoid the teratogens by the pregnant women as much as possible. Some known teratogens are the use of alcohol, the use of drugs, and tobacco.

Use of Alcohol and Tobacco

The use of alcohol and tobacco during pregnancy and lactation has been found to be harmful to the developing fetus. When the alcohol reaches a certain level in the bloodstream of the mother, certain danger signals are produced in her. These are nervousness, wakefulness, and irregular heart-beats, and these effects are transferred to the fetus as well. Alcohol taken by pregnant woman passes through the placenta and affects the fetus growing in her womb. Alcohol use during pregnancy has been found to be the leading preventable cause of intellectual disabilities in children (Hadlock, 1985). The use of tobacco by pregnant women has been found to be related to premature delivery and a decrease in breast milk flow in lactating mothers.

Alcohol use can lead to fetal alcohol spectrum disorders (FASD), which is linked to heart defects, body malformations, and intellectual disability. It has life-long consequences for the child, ranging in severity from minor to major. It is recommended to avoid the consumption of alcohol during the pregnancy to the maximum possible extent.

The children suffering from FASD may have characteristics of small head size and abnormal facial features. Cognitively, these children may have a poor judgment, poor impulse control,

higher rates of Attention Deficit Hyperactive Disorder (ADHD) and learning issues, and lower IQ scores. These symptoms may persist into adulthood (Lunde, A. et al., 2007).
Use of Drugs:

If the mother takes the drugs during the pregnancy, it is harmful to the fetus and birth defects may take place. These medications may be in the form of illegal drugs or prescribed drugs or over the counter drugs.

The use of illicit psychoactive drugs (Illegal drugs) such as heroin, cocaine, and methamphetamine can cause a myriad of problems for the developing fetus: babies can be born addicted to certain drugs and are also more likely to be born prematurely, have low birth weight, attention and behavioral problems, neurological impairment, and experience other physical defects.

All prescribed drugs during pregnancy have not equal effects on the developing fetus. Some drugs (Usually classified as class A drugs) are always safe while the other drugs (classified as class X drugs) have proven to be damaging to the fetus (Voigt, 2006). It is often recommended to avoid the use of unnecessary medication during the pregnancy.

Maternal Disease
If the mother has any disease which affects her metabolism, it can influence the developing fetus to a certain extent. Maternal health and illness may affect the fetus in the following ways:

Endocrine Disorders
Endocrine disorders such as thyroid deficiency in the pregnant women may produce cretinism in the developing fetus in which the bones and cartilage fail to develop, the abdomen becomes large and flabby, skin becomes rough and coarse, the hair shaggy, and intelligence developed sub-normal. The endocrine imbalance may also result in mongolism (Down's syndrome)-one type of intellectual disability in which the skull is small, and pointed and the eyes slanting.

Infectious Disease
There are a number of infectious diseases which is contacted by the mother during pregnancy may be damaging to the unborn child. Some of these diseases are syphilis, gonorrhea, polio-myelitis, rubella, herpes, AIDS, and so on. These diseases may cause stillbirth, miscarriage, blindness, deafness, mental deficiency, microcephaly, motor disorders, congenital immune system failure, etc. Herpes virus is one of the most common maternal diseases and can be transmitted to the fetus, leading to deafness, brain swelling, and intellectual disability. Those women whom sufferings from herpes virus are often advised and encouraged to deliver via cesarean to avoid transmission of the virus (Hanson & Gluckman, 2014).

- **Prolonged and wasting diseases:** such as tuberculosis and diabetes have effects on unborn children, similar to those of malnutrition.
- **The Rh blood factor:** Incompatibility between the maternal and paternal blood types has been found to cause miscarriage, stillbirth, abortion, and low-grade intelligence in children.

Smoking

Smoking tobacco is one of the most common teratogens especially found to lower and upper socioeconomic families. Because, nicotine travels through the placenta to the fetus. When the mother smokes, the developing fetus experiences a reduction in blood oxygen levels. Smoking by the pregnant women may lead to premature delivery, low birth weight of the baby, that can be produce weakened immune system, poor respiration, neurological impairment and Sudden Infant Death Syndrome (SIDS) (Bornstein, 2005).

SIDS is defined as the sudden and unexplained death of a child who is less than one year of age. Other symptoms resulting in prenatal exposure to smoke may include inattentiveness, muscle tension, and colic (a form of pain which starts and stops abruptly, and occurs due to muscular contractions in the body). The risk is increased if the mother smokes more.

Other Teratogens

Other teratogens that may adversely affect the growing fetus may include: radiation, pollution, and infectious disease. Radiation may increase the risk of childhood cancer, as well as emotional and behavioral disorders in children; because of this, it is recommended that pregnant women avoid x-rays unless necessary. Pollution, such as exposure to mercury, or PCBs, can cause physical deformities, abnormal speech, and difficulty with motor coordination. If pregnant women's suffering from any infectious diseases such as viruses or parasites can also cause brain damage to the fetus or even death.

Maternal Stress and Depression

The prenatal stress felts by pregnant mothers can have negative effects on both the mother and the child and can harm both mother and child. Stress may enhance the physiological changes in pregnant women that could harm the developing fetus. Such women are more likely to engage in behaviors that could negatively affect the fetus, such as they may start smoking to reduce stress, drug use for abortion, and start taking alcohol. There are several factors responsible for the occurrence of maternal stress and leads to depression in pregnant women. Some of them are unplanned pregnancy, difficulty becoming pregnant, history of abuse, and economic or family problems.

To overcome the depression, often pregnant women take antidepressants that worsen the situations for the developing fetus. Depression itself is independently associated with negative pregnancy outcomes.

Maternal Age

Maternal age is also an important factor for the birth of disabled children. After the age of 35 years, if the women get pregnant, there is a very rapid change in the endocrine balance of women. This change affects the unborn child by slowing down the maturation of ova and by retarding the development of the fetus. This may result in intellectual disability and physical deformity in the children of mothers who conceive beyond the age of 35 years.

Uterine Crowding: In the case of multiple births during single pregnancy, the uterine crowding may produce dislocation of some bone structure in the developing fetus. Hence, fetus is not in the position to assimilate the substances necessary for normal development.

Solutions and Recommendations: The prenatal period is often considered very critical for the proper development of the fetus. Our growth will start prior to our birth. When the mother conceives the child, whatever they feel, they experienced and learned that affect the

baby throughout life. Pregnant women are the backbone for the birth of the healthiest child. Various genetic and environmental factors can significantly affect the development of the child among them most of the genetic factors are not in our hands to control while the environmental factors can be controlled at the maximum fullest extent.

Important nutrients and other positive factors pass from the mother's blood into the fetal blood that helping and supporting fetal growth and development. The pregnant women must take proper diet (qualitative and quantitative food) enriched with vitamins, minerals, and other nutrients. Maternal blood carries glucose that provides energy for fetal metabolism. Maternal blood also carries Amino-Acid that helps to produce proteins needed for fetal development. If pregnant women become malnourished, the fetus might not get sufficient nutrients that slowing their rate of growth and development and possibly resulting in an under-developed newborn that might be a cause of disability.

The most important factor that is often neglected in our country is the maternal health. For the sake of proper growth of the developing fetus, the maternal health needs to be kept intact. The chances of suffering with gestational diabetes may increase, if the blood glucose level of the pregnant women is too high. It might cause the baby to be too large and have a difficult birth. The mother must be kept free from endocrine disorders such as thyroid deficiency that may produce cretinism in the developing fetus. Apart from other symptoms, cretinism may produce intellectual disability in which the intelligence of the child can't develop to the maximum fullest degree. The mother must be kept free from infectious diseases such as syphilis, gonorrhea, rubella, herpes, AIDS and sexually transmitted diseases (STD). These diseases may cause stillbirth, miscarriage, blindness, deafness, intellectual disability, microcephaly, motor disorders, congenital immune system failure, etc. Maternal infections such as viruses or parasites can also cause brain damage to the fetus or even death. The blood RH factor incompatibility between the mother and father must be ruled out prior to pregnancy to produce the healthiest child.

The teratogen effects – harmful environmental effects – can also be reduced to the extent possible. The pregnant women should not take alcohol, tobacco, cigarette smoking, use of self-prescribed medicine, etc. to safe pregnancy and reduce fetal alcohol spectrum disorders in the children.

Alcohol intake during pregnancy is most significantly associated with the birth of children with intellectual disabilities. It is in our hand to reduce the alcohol consumption during pregnancy to produce the safe delivery and healthiest child. The use of tobacco by pregnant women has been found to be related to premature delivery and a decrease in breast milk flow in lactating mothers. It is always better to avoid X-rays to pregnant women unless it is necessary. Ultraviolet rays of the X-rays may damage the brain tissue of the developing fetus. Pollution, such as exposure to mercury, or PCBs should be avoided as it can cause physical deformities, abnormal speech, and difficulty with coordination. The older mother may produce a disabled child. The pregnancy in the age range of 22 to 32 is always safe and free from hazards.

Maternal emotions such as stress, anxiety, tension, depression and so on can also influence the developing child through endocrine changes that took place in the mother. If an expectant mother is at a constant state of stress, anxiety, and tension, her endocrine system may become imbalanced and it makes damage to the unborn child. It leads to increase fetal activity resulting in less than the average birth the weight of the infant. These emotional

states not only affect the fetus, but also carried over, and affect the post-natal adjustment of the newborn. Resulting in turn behavioral upset or deviant behavior may take place. At times intellectual disability, cleft palates may also result. Hence, it is recommended that the negative emotions of pregnant women should be minimizing at the maximum possible extent.

CONCLUSION

The prenatal period is very crucial for both pregnant women, and the developing fetus. This period has a tremendous effect on the growth and development of the fetus. Not only this, but this period is also vulnerable to effect by various teratogens. As we all have seen, there are a number of dangers that can pose a potential risk to the growing fetus. Some of the most common dangers and environmental risks from teratogens can be prevented or minimized to the maximum possible extent. Genetic and hereditical issues are generally unavoidable. However, it can be also deducted through genetic tests if attempts are made within the due time schedule. In both of the cases, early prenatal care of pregnant women, and the developing fetus can help both to cope up with potential problems of prenatal development.

Developmental irregularities result from environmental irregularities that occur at the same time as the formation of a particular organ begins. A younger developing organism is likely to be more seriously affected by environmental disturbances. In the embryonic stage, some developments are considered as critical developmental periods. During these periods the environmental disturbances may be more hazardous than in other stages. The first three months of prenatal life is the most critical period. All the organs are in the formative stage, so any organ may become malformed due to environmental disturbances. From the sixth month to nine-month pregnancy hazards are fewer but some environmental changes may bring about a setback to the mental growth of the child.

Therefore, the total period of pregnancy is a period when proper care must be taken, and conditions made such that the unborn child proceeds through normal developmental pattern and no physical and mental damage occurs to them, which can make them post-natal life miserable.

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Conflict of Interest

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